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NOTES AND LITERATURE

GENERAL BIOLOGY

Specific Characters in Early Embryos.— In a recent contribution to the *Naturalist* it is asked if "by and by we are going to find specific characters in the eggs of animals as well as in their adult condition." In the seventeenth century this was believed to be true, since the egg was supposed to contain in miniature the adult form to which it should give rise. Early in the nineteenth century, however, it was thought that the embryos of the higher animals passed successively through stages corresponding with the adults of lower forms. With the theory of evolution, it began to be considered that the early embryos in different groups of animals were identical and that specific characters were late acquisitions. A few interesting expressions of this opinion are as follows:

"Embryology has revealed the strange resemblance which exists, at the beginning of their formation, between the embryos of different vertebrates; it has shown how each embryo before taking its final form hesitates, so to speak, between different specific forms."[1]

"Take, for example, the case of the highest organism, Man.... When his animality becomes established, he exhibits the fundamental anatomical qualities which characterize such lowly animals as polyps and jelly fish. And even when he is marked off as a vertebrate it cannot be said whether he is to be a fish, a reptile, a bird, or a beast. Later it becomes evident that he is to be a mammal; but not till later can it be said to which order of mammals he belongs."[2]

"The embryo of a mammal at the stage which represents a gill-bearing vertebrate, in all cases which I have examined, ranges from one third of an inch to an inch in length; the former size belongs to the smaller kinds, the latter to the larger. Know one, know all; one diagram would represent all, one description serve for all."[3]

"The careful investigation and comparison of embryos of man and other vertebrates. . . . is highly instructive and discloses to the thoughtful person deeper and weightier secrets than are to be found in the so-called "revelations" of all the religions of the earth. Compare attentively the successive stages of the chick, pig, rabbit, and man shown in the accompanying figure. In the first stage (the upper row), in which the head with the five cerebral vesicles and the gill arches are clearly marked out but the limbs are still wholly absent, the embryos of all vertebrates from fishes to man differ from one another either unessentially or not at all. In the second stage (the lower row), in which the limbs have begun to develop, distinctions between the embryos of lower and higher vertebrates have begun to appear; yet the human embryo even now is scarcely to be distinguished from those of the higher mammals. . . . These are facts the significance of which cannot be overestimated."[1]

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[1] Cresson, A. Les bases de la philosophie naturaliste. Paris, Félix Alcan, 1907. p. 64.

[2] Romanes, G. J. Darwin, and after Darwin. Chicago, Open Court Publ. Co., 1892. p. 119.

[3] Parker, W. K. On mammalian descent. London, Charles Griffin Co., 1885. p. 14–15.

As drawings of embryos, the well known figures of Haeckel here reproduced are totally valueless. The front limbs have been transferred to the neck, and the characteristic features by which any one familiar with embryos can distinguish a pig from a rabbit have been wholly overlooked. Although Parker declared that 'one diagram would represent all,' his figure of the embryo mole could not possibly be mistaken for a pig. Moreover the pig at this stage could be distinguished from the rabbit or man by its pancreas alone. The comparative study of embryos to detect generic and specific differences has not been carried far, but from such publications as Keibel's *Normentafeln* of the pig and rabbit it is evident that at no stage in their development is there a confusing similarity in external form.

In place of Haeckel's upper row of figures, those of still younger stages may be substituted, in which the differences are more obvious. The spherical yolk of the hen's egg, the elongated vesicle of the sheep (that of the pig being quite as long but not so slender), the round smooth vesicle of the rabbit and the villous human vesicle are radically different from each other. Since these membranous structures are parts of the embryo they must be regarded as expressions of differences existing at an early stage. Since a given egg cell can produce only one species of animal it must, according to current embryological belief, contain specific characteristics, and if an inheritable peculiarity appears in any adult animal it will modify to some extent the egg cell and every succeeding stage of development. Thus, according to

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[1] Haeckel, E. Anthropogenie. 3rd ed. Leipzig, W. Engelmann, 1877, p. 288–289.

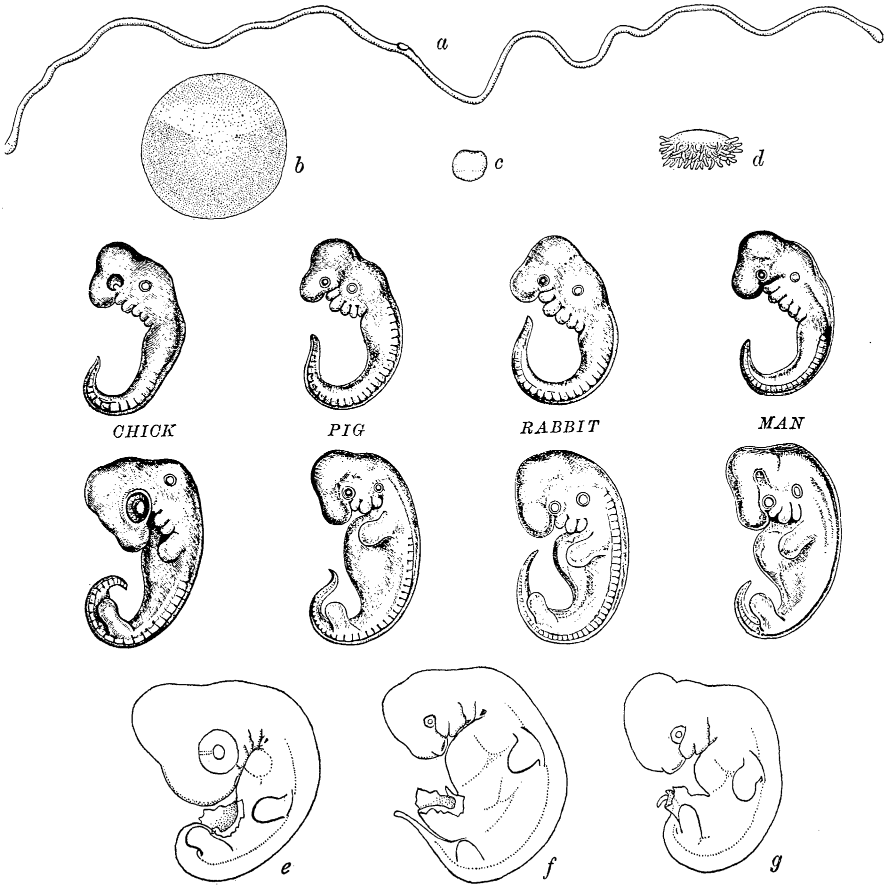

Fig. 1.— The two rows of embryos of the chick, pig, rabbit, and man are from Romanes' copy of Haeckel's figures. The others are:— *a*, sheep, 12 days $2\frac{1}{4}$ hours, $\frac{2}{3}$ nat. size (Bonnet); *b*, chick, 33 hours incubation, $\frac{2}{3}$ nat. size; *c*, rabbit, 7 days, × 2; *d*, man, 12–13 days × 2 (Reichert); *e*, chick, 5 days, 8.5 mm.; *f*, pig, 20 days, (?), 9.0 mm.; *g*, rabbit, $12\frac{1}{2}$ days, 8.5 mm.

Hertwig, there are as many kinds of egg cells as there are species or kinds of animals or plants. Morgan, after an interesting historical consideration of the question, says,— "I should not expect to find the embryos of any two species identical at any stage in their development, but at most there might be a close resemblance between them."[1]

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[1] Morgan, T. H. Evolution and adaptation. New York, The Macmillan Co., 1903, p. 74.

Montgomery states that two species are as distinct in the egg-cell stage as in any later one, "no matter whether the differences are as perceptible or not."[1] Such a statement, however, evades the question whether or not embryos of related species can actually be distinguished from one another.

The four suborders of rodents, represented by the squirrel, mouse, guinea pig, and rabbit respectively, according to Lee may be distinguished at very early stages. His studies do not enable him as yet to recognize the genera of one suborder,— namely the gophers, prairie dogs, squirrels, and chipmunks — until the embryos are far advanced. Differences in tunicate eggs of closely related genera have, however, been recorded by Conklin, and McClung can distinguish several species in one genus of grasshoppers by the chromosomes of their germ cells.

F. T. L.

ZOOLOGY

New Text Books of Zoology.— The most important service that biology can render to students is to train their reason and their power of observation, and to free them from a too deep reverence for authority. This service can also be performed by the other natural sciences, physics and chemistry, which are commonly included in the curricula of high schools but which require expensive apparatus beyond the reach of many schools. Biology, however, can be profitably taught with so slight an equipment that every school can afford to undertake to teach botany or zoology, or both. The teaching of biology has often failed to yield the results that educators have expected. This is so because teachers too often yield to the temptation to tell the students the facts and theories which they ought to learn by their own efforts, instead of teaching them how to discover, to classify, and to draw proper conclusions.

Professor Glenn W. Herrick, of the Mississippi Agricultural College has endeavored to meet the needs of the high school of limited means whose students will, as a whole, have no further instruction in biology. He presents to such students a laboratory guide containing directions for the examination (we can scarcely say for the dissection) of some-

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[1] Montgomery, T. H. The analysis of racial descent in animals. New York, Henry Holt and Co., 1906. p. 192.